Physics 4A
Spring 2025

ave. = 6.0
σ = 3.0

Name Answer Key

Lab: 8:00 am 11:10 am 2:30 pm (circle one)

Quiz #6: Dynamics II

Problem 1 (2 points)
A boy is whirling a stone around his head in a horizontal circle by means of a string. The string makes one complete revolution every second, and the tension in the string is T. The boy then speeds up the stone, keeping the radius of the circle unchanged, so that the string makes two complete revolutions every second. What happens to the tension in the string?

↳ period cut in ½ $T_{ension} = mv^2/r$ $v = 2\pi r/T$

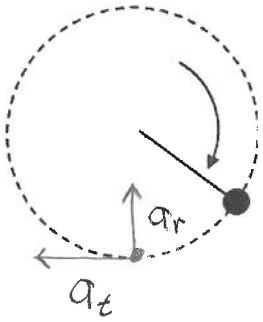
E

a) The tension is unchanged.
b) The tension reduces to half of its original value.
c) The tension increases to twice its original value.
d) The tension reduces to one-fourth of its original value.
(e) The tension increases to four times its original value.

$T_{ension} = 4\pi^2 mr/T^2$

If period is cut in half, tension increases by a factor of 4

Problem 2 (3 points)
A 1.50 kg rock is being swung clockwise in a vertical circle of radius 0.55 m. When the rock is at its lowest point and moving to the left, its speed is 2.25 m/s and is increasing at a rate of 7.40 m/s every second. What is the magnitude of the rock's total acceleration?



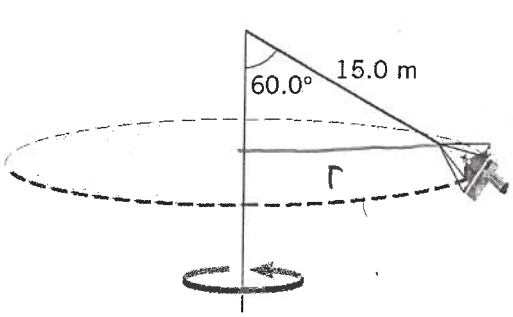
$a_r = v^2/r = \frac{(2.25\ m/s)^2}{0.55\ m} = 9.20\ m/s^2$ up

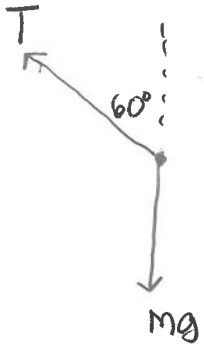
$a_t = 7.40\ m/s^2$ left

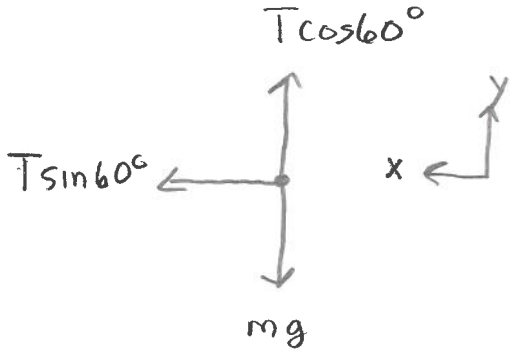
$a_{total} = \sqrt{a_t^2 + a_r^2} = \sqrt{(7.40\ m/s^2)^2 + (9.20\ m/s^2)^2}$

$a_{total} = 11.8\ m/s^2$
$= 12\ m/s^2$

Problem 3 (5 points)
A swing ride at a carnival consists of chairs that are swung in a circle by a 15.0 m cable attached to a vertical rotating pole as shown in the figure. Suppose that the total mass of the chair and its occupant is 195 kg.







a) What is the tension in the cable attached to the chair?

$r = (15.0\,m)\sin 60° = 12.99\,m$

$\sum F_y = ma_y = 0$

$T\cos 60° - mg = 0$

$T = mg/\cos 60° = \dfrac{(195\,kg)(9.80\,m/s^2)}{\cos 60°} \rightarrow$ **$T = 3822\,N$**

b) What is the speed of the chair?

$\sum F_x = ma_x = mv^2/r$

$T\sin 60° = mv^2/r \rightarrow v = \sqrt{\dfrac{rT\sin 60°}{m}}$

$v = \sqrt{\dfrac{(12.99\,m)(3822\,N)\sin 60°}{195\,kg}} \rightarrow$ **$v = 14.8\,m/s$**